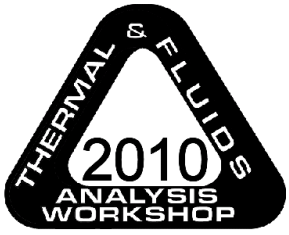
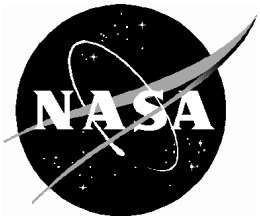
Thermal and Fluids Analysis Workshop 2010

Lyndon B. Johnson Space Center



Proceedings of a workshop
hosted by the Lyndon B. Johnson Space Center
at the South Shore Harbor Resort and Conference Center
League City, Texas
August 16-20, 2010



National Aeronautics and
Space Administration

FOREWORD

The 2010 Thermal and Fluids Analysis Workshop (TFAWS) was sponsored by the NASA/Johnson Space Center and held at the South Shore Harbor Resort and Conference Center. This was the third time that JSC had the honor of hosting the conference; the last time was in 2002.

The workshop brought together engineers from around the world who work in industry, academia, and government. The theme for TFAWS 2010 was "Innovation of Technologies for Tomorrow through Teamwork Today." Four paper sessions showcased papers from a variety of disciplines: Passive Thermal, Aerothermal, Active Thermal, and Interdisciplinary/Technology.

The organizers of this year's workshop want to thank all of the participants, paper authors, and vendor representatives. The opportunity to coordinate the conference has been a great experience.

TABLE OF CONTENTS

PASSIVE THERMAL PAPER SESSION

Chairs: David J. Coote , NASA/Stennis Space Center
Harry M. Ryan, NASA/Stennis Space Center

SESSION A

Ares 1-X Thermal Model Correlation and Lessons Learned
Ruth Admundsen, NASA/Langley Research Center

A Passive Thermal Analysis of a Small Satellite
Wyatt Hurlbut, University of Alaska Fairbanks

Preliminary Evaluation of Passive Thermal Control for the Soil Moisture Active & Passive (SMAP) Radiometer
A. J. Mastropietro[#], Eug Kwack[#], Michael Spencer[#], Jeff Piepmeier, Derek Hudson*, James Medeiros*, Pam Hoffman[#], Matt Stegman[#], Keith English[#], Subha Comandur[#]*
[#]Jet Propulsion Laboratory, California Institute of Technology
**NASA Goddard Spaceflight Center*

Development of a Response Surface thermal Model for Orion Mated to the International Space Station
Stephen Miller, NASA/Johnson Space Center

Radiator Study for Stationary Lunar Landers
Brian O'Connor, NASA/Marshal Space Flight Center

Initial Assessment of a Rapid Method of Calculating CEV Environmental Heating
J.T. Pinckney and A.H. Milliken, Engineering and Science Contract Group

SESSION B

Determination of Wall Heat Loadings From Internal Heat Sources for Complex Geometries
Matthew Carroll, Texas A&M Galveston

A Method of Spacecraft Passive Thermal Analysis Applicable to Mission Operations
Vern Howard, GHG Corporation

Use of a Hybrid Edge Node-Centroid Node Approach to Thermal Modeling
Hume Peabody, NASA/Goddard Space Flight Center

Using MathCad to Evaluate Exact Integral Formulations of Spacecraft Orbital Heats for Primitive Surfaces at any Orientation
J.T. Pinckney, Engineering and Science Contract Group

RCC Plug Repair Thermal Tools for Shuttle Mission Support
Alvaro C. Rodriguez and Brian P. Anderson, NASA/Johnson Space Center

Development of Instrument Specific Environments Heat Rates in Thermal Desktop and SINDA Formats
Bruce Williams, Johns Hopkins University, Applied Physics Laboratory

---

AEROTHERMAL PAPER SESSION
Chair: William A. Wood, NASA/Langley Research Center

SESSION A

Aeroheating Mapping to Thermal Model for Autonomous Aerobraking Capability
Ruth Adundsen, NASA/Langley Research Center

Thermal Science Results of the Ionspheric Science and Inertial Sensing (ISIS) Sounding Rocket Payload
T.E. Caswell, United Space Alliance
D.L. Thornsen and J.G. Hawkins, University of Alaska Fairbanks

Sting and Modeling Effects on Aftbody Heat Flux and Surface Streamlines for Blunt Bodies
Maria Pulsonetti, NASA/Johnson Space Center

Aerothermal Protuberance Heating Design and Test Configurations for Ascent Design
Charles Martin, United Space Alliance

Aerothermal Protuberance Design heating Test Data Analysis
Pedro Lopez Jr., NASA/Johnson Space Center

Methodology for the Assessment of a 3D Conduction Effects in an Aerothermal Wind Tunnel Test
Brandon Oliver, NASA/Johnson Space Center

SESSION B

Simulation of Supersonic Freestreams with Counter Flowing Jets: Validation Study
Sutikno Wirogo, ANSYS Inc.

Numerical Simulation of External Aerodynamics of the Apollo Command Module: Validation Study
Sutikno Wirogo, ANSYS Inc.

ACTIVE THERMAL PAPER SESSION

Chairs: Grant C. Bue, NASA/Johnson Space Center
Eric T. Malroy, NASA/Johnson Space Center

SESSION A

Heat Rejection of Advanced Crew Escape Suits in Hot Postlanding Environments
Grant Bue, NASA/Johnson Space Center

Space Suit CO2 Washout During Intravehicular Activity
Philip Augustine, Engineering and Science Contract Group

Portable Life Support Subsystem Thermal Hydraulic Performance Analysis
Bruce Barnes, John Pinckney and Bruce Conger, Engineering and Science Contract Group

Analysis and Design of Phase Change Thermal Control for Light Emitting Diode (LED) Spacesuit Helmet Lights
John Keller, Engineering and Science Contract Group

Enhancement of the Performance of Thermal Contorl Systems Using Nanofluids
Debendra K. Das, Ravikanth Vajjha, and Roy Strandberg, University of Alaska Fairbanks

SESSION B

Modeling Membrane Filtration for Water Recovery
P. M. Boyle and B. C. Houchens, Rice University
A. S. Kim, University of Hawaii at Manoa

Trade Study on Reduced Curvature Radiator Configuration for Orion
Xiaoyen Wang, NASA/Glenn Research Center

Advanced Variable Conductance heat Pipes and Pressure Controlled Heat Pipes
W. G. Anderson, J. R. Hartenstine, David B. Sarraf, Calin Tarau, and Kara L. Walker, Advanced Cooling Technologies, Inc.

Variable Thermal Conductance Link for Lunar Landers and Rovers
William G. Anderson, John R. Hartenstine, and Kara L. Walker, Advanced Cooling Technologies, Inc.
Jeffrey T. Farmer, NASA/Marshall Space Flight Center

Systems Modeling for Crew Core Body Temperature Prediction Postlanding
Cynthia Cross, NASA/Johnson Space Center
Dustin Ochoa, Jacobs Engineering

Analysis of Water Vapor Condensation on Constellation Space Suit System Connectors
Peri Sabhapathy and Siraj Jalali, Oceaneering Space Systems

INTERDISCIPLINARY PAPER SESSION

Chair: Frank Milos,NASA/Ames Research Center

SESSION A

Implementation of Accurate Lumped Parameter Submodels in the Transient Thermal Analysis of the Ares I Upper Stage Thrust Vector Control Hydraulic System

R. J. Christie and C. D. Fisher, NASA/Glenn Research Center

A Coupled Multiphysics Analysis for a Hypersonic Vehicle

E. L. Blades[1], E. A. Luke[2], R. S. Miskovish[1] and P. Shah[1]

[1]ATA Engineering, Inc.

[2]Center for Advanced Vehicular Systems, Mississippi State University

Potential of the Spectral Element Method in Flow Simulations of Aerospace Systems Shift

K. E. Davis and B. C. Houchens, Rice University

Passive 2-Phase Liquid Techniques to Control Temperatures in Microelectornics and Power Systems

Phillip E. Tuma, 3M Company

Nano-Devices for Thermal Management, Sensing and Thermal Storage

D. Banerjee, Texas A&M University

Orion Pad Abort 1 Thermal Flight Operations and Lessons-Learned
Joseph F. Gasbarre, NASA/Langley Research Center
David R. Buffington and Darrel S. Lamb, Lockheed Martin Space Systems Corporation

Thermal Vacuum Testing: Test Preparation
Michael A. McCullar, Jacobs Technology

Feasibility Study of Interstellar Missions Using Laser sail Probes Ranging in Size from the Nano to the Macro
Eric T. Malroy, NASA/Johnson Space Center

Recent Advances in Thermal Mechanically Coupled Analysis Using MSC
Ted B. Wertheimer and Sean Harvey, MSC Software
Robert Minaie, Wichita State University